

AVIZAT,
DIRECTOR EXECUTIV TEHNIC



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CAIET DE SARCINI

EMIȚĂTOARE FM CU SISTEM DE REZERVARE ACTIVA ȘI FILTRE TRECE BANDĂ - FM

Sistem cu două emițătoare FM + rezervă activă tip 2+1 @ 1kW: 7 bucăți
Sistem cu două emițătoare FM + rezervă activă tip 2+1 @ 0,5kW: 1 bucată
Sistem cu un emițător FM + rezervă activă tip 1+1 @ 1kW: 5 bucăți

CUPRINS:

- LOCAȚII ȘI CONDIȚII DE LIVRARE EMIȚĂTOARE ȘI FILTRE
- COTAȚII EMIȚĂTORI ȘI FILTRE
- SPECIFICAȚII TEHNICE EMIȚĂTOARE
- SPECIFICAȚII TEHNICE FILTRE
- SPECIFICAȚII TEHNICE IP
- CONFORMITATE TEHNICĂ EMIȚĂTOARE ȘI IP
- CONFORMITATE TEHNICĂ FILTRE
- CRITERII DE EVALUARE OFERTĂ
- TESTARE EMIȚĂTOARE
- TESTARE FILTRE

LOCAȚII ȘI CONDIȚII DE LIVRARE (Delivery conditions and location)

I. Locații livrare echipamente (Delivery location)

No	Site	Delivery adress
1	ALEXANDRIA	Str.,Calea Dunarii nr.145, site ROMTELECOM, jud. Teleorman
2	BRĂȘOV-FĂMPA	Vârful Tâmpa, Brașov, jud. Brașov
3	DĂBULENI	Str. Marin Pădă nr.4, Dăbuleni, jud. Dolj
4	GIURGIU	Bdul Mihai Viteazul nr.1, Giurgiu, jud. Giurgiu
5	HOTĂRELE	Com. Hotărele, jud. Giurgiu
6	MAHMUDIA	Deal. Besepe, Com. Mahmudia, jud. Tulcea
7	MOLDOVA NOUĂ	Potejona, jud. Caraș Severin
8	NEGREȘTI	Vârful Jetezate, Negrești-Oas, jud. Satu Mare
9	SIGHEȚ-FM	Dealul Dobates, Sighețu M armatei, jud. Maramures
10	VĂRATEC	Vârful Văratec, Baiuț, jud. Maramures
11	VASLUJ	Dealul Mirenilor, Com. Tanacu, jud. Vaslui
12	HUSI	Deal Dobrina, Husi, jud. Vaslui

II. Termenul de livrare va fi de cel mult 90 de zile. (Delivery time: maxim 90 days)

III. Garanția tehnică a produselor va fi de minimum 24 luni. (Guarantee periode: 24 months)

A. FULL-SOLID STATE FM-VHF TRANSMITTER 2+1 @ 1 kW

No	FURNITURE	REQUIREMENTS	Q-ty	PRICE CIP-site ALEXANDRIA	PRICE CIP-site BRASOV-TAMPA	PRICE CIP-site GIURGIU	PRICE CIP-site MAHMUDIA	PRICE CIP-site NEGRESTI	PRICE CIP-site VARATEC	PRICE CIP-site VASLUI
1	Active reserved system in 2+1 configuration	According with Technical Specifications System power: 2 x main transmitters = 1kW 1 x spare transmitter = 1kW - Local and PC remote management and monitoring facilities: hardware+software/firmware; -All necessary devices and software to integrate the transmitter into the Radiocomunicatii monitoring system (e.g. SNMP protocol, MIB files, etc. via TCP/IP port for ethernet HTML5 web interface or software monitoring/management • FM demodulator (1 pc / main tx) • Modulation monitor and metering • Audio monitor - Spare TX shall be able for automatic operation using RDS configuration of each of the two main transmitters • Scrolling PS and radio text messaging • PS 8 characters and up to 128 characters scrolling messaging - TCP/IP port for ethernet web GUI or software management • Spare transmitter for emergency operation, using audio settings of each of the two main transmitters • Multiband processing, EQ, AGC, Clipping - processing/ bypass selectable For external device: • balanced analog input : 600 ohm/±10kHzm selectable • balanced analog output: 600 ohm, balanced, (-10 dBu to +14 dBu adjustable) • balanced digital input: 110 ohm • balanced digital output: 110 ohm (-20 dBFS to 0 dBFS adjustable) • auto/manual switch audio input: - MPX output - XLR connectors for audio input/output	1 Pc							
2	INTERFACE FOR CONTROL and MONITORING, Local and Remote		1 Pc							
3	RDS ENCODERS SET suitable for 2+1 configuration: - Fully compliant with EEC standard 62106		1 Pc							
4	AUDIO PROCESSORS SET suitable for 2+1 configuration		1 Pc							
5	TECHNICAL MANUAL AND COMPLETE DOCUMENTATION	In English	1 Pc							
6	COMMISSIONING AND SITE ACCEPTANCE TESTS	No of supplier specialist & working days Supplier will support all cost for travelling, accommodation, daily expenses. Buyer will support transport from hotel to site and back.	1 Pc							

Total price A

QUOTATION LIST

B. FULL SOLID STATE FM-VHF TRANSMITTER 2+1 @ 0,5 kW

No	FURNITURE	REQUIREMENTS	Q-ty	PRICE CIP-site BORSEC
1	Active reserved system in 2+1 configuration	According with Technical Specifications System power: 2 x main transmitters = 0,5kW 1 x spare transmitter = 0,5kW	1 Pc	
2	INTERFACE FOR CONTROL and MONITORING, Local and Remote	- Local and PC remote management and monitoring facilities: hardware+software/ firmware; -All necessary devices and software to integrate the transmitter into the Radiocomunicatii monitoring system (e.g. SNMP protocol, MIB files, etc. via TCP/IP port for ethernet HTML5 web interface or software monitoring/management Audio and modulation monitoring • FM demodulator (1 pc / main tx) • Modulation monitor and metering • Audio monitor	1 Pc	
3	RDS ENCODERS SET suitable for 2+1 configuration: - Fully compliant with IEC standard 62106	- Spare TX shall be able for automatically operation using RDS configuration of each of the two main transmitters: - Scrolling PS and radio text messaging - PS 8 charactes and up to 128 characters scrolling messaging - TCP/IP port for ethernet web GUI or software management - 6 AF (alternate frequencies) at least	1 Pc	
4	AUDIO PROCESSORS SET suitable for 2+1 configuration	- Spare TX will be able for automatically operation using audio settings of each of the two main transmitters - Multiband processing, EQ, AGC, Clipping - processing/ bypass selectable For external device: - balanced analog input: 600 ohm/>10kohm selectable - balanced analog output: 600 ohm, balanced, (-10 dBu to +14 dBu adjustable) - balanced digital input 110 ohm - balanced digital output: 110 ohm (-20 dBFS to 0 dBFS adjustable) - auto/manual switch audio input - MPX output - XLR connectors for audio input/output all necessary interconnecting cables	1 Pc	
5	TECHNICAL MANUAL AND COMPLETE DOCUMENTATION	In English	1 Pc	
6	COMMISSIONING AND SITE ACCEPTANCE TESTS	No of supplier specialist & working days Supplier will support all cost for travelling, accommodation, daily expenses. Buyer will support transport from hotel to site and back	1 Pc	

Total price B

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QUOTATION LIST
C. FULL SOLID STATE FM-VHF TRANSMITTER 1+1 @ 1 kW

No	FURNITURE	REQUIREMENTS	Q-ty	PRICE CIP-site DĂBULENI	PRICE CIP-site HOTARELE	PRICE CIP-site MOLDOVA NOUĂ	PRICE CIP-site SIGHET	PRICE CIP-site HUSI
1	Active reserved system in 1+1 configuration	According with Technical Specifications System power: 1 x main transmitter = 1kW 1 x spare transmitter = 1kW - Local and PC remote management and monitoring facilities: hardware/software/ firmware; - All necessary devices and software to integrate the transmitter into the Radiocomunicatii monitoring system (e.g. SNMP protocol, MIB files, etc. via TCP/IP port for ethernet HTML5 web interface or software monitoring management) • FM demodulator (1 pc / main tx) • Modulation monitor and metering • Audio monitor	1 Pc					
2	INTERFACE FOR CONTROL and MONITORING, Local and Remote		1 Pc					
3	RDS ENCODERS SET suitable for 1+1 configuration: - Fully compliant with IEC standard 62106.	- Spare TX shall be able for automatically operation using RDS configuration of the main transmitter - Scrolling PS and radio text messaging - PS 6 characters and up to 128 characters scrolling messaging - TCP/IP port for ethernet web GUI or software management - 6 AF (alternate frequencies) at least - Spare TX shall be able for automatic operation using audio settings of each of the two main transmitters - Multiband processing, EQ, AGC, Clipping - processing/ bypass selectable For external device: - balanced analog input: 600 ohm/ >10kohm selectable - balanced analog output: 600 ohm, balanced, (-10 dBu to +14 dBu adjustable) - balanced digital input: 110 ohm - balanced digital output: 110 ohm (-20 dBFS to 0 dBFS adjustable) - auto/manual switch audio input - MPX output - XLR connectors for audio input/output	1 Pc					
4	AUDIO PROCESSORS SET suitable for 1+1 configuration		1 Pc					
5	TECHNICAL MANUAL AND COMPLETE DOCUMENTATION	In English	1 Pc					
6	COMMISSIONING AND SITE ACCEPTANCE TESTS	No of supplier specialist & working days Supplier will support all cost for travelling, accommodation, daily expenses. Buyer will support transport from hotel to site and back.	1 Pc					

Total price C

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QUOTATION LIST

D. SPARE PART KIT for 2+1 @ 1kW and 1+1@1 kW systems

No	FURNITURE	REQUIREMENTS	Q-ty	PRICE CIP
1	RECOMMENDED SPARE PARTS *The offerer will provide a complete list with the spare parts and price for each item/each set.	Each set will contains recommended minimum spare parts kit (electronic boards/modules, power supply, power amplifiers, air filters, air fan, calibrated fuse, RF power transistor, display, switching relays, etc). The 4 sets will be identically *The total value of the recommended spare parts kit will be minimum 5% of the system value of 2+1 @ 1kW and 1+1@1 kW systems	4 Set	1 set/site Alexandria; 1 set/site Negreesti; 1 set/site Vaslui; 1 set/site Dabuleni

Total price D

E. SPARE PART KIT for 2+1 @ 0.5 kW system

No	FURNITURE	REQUIREMENTS	Q-ty	PRICE CIP
1	RECOMMENDED SPARE PARTS *The offerer will provide a complete list with the spare parts and price for each item/each set.	Each set will contains recommended minimum spare parts kit (electronic boards/modules, power supply, power amplifiers, air filters, air fan, calibrated fuse, RF power transistor, display, switching relays, etc). The value of the recommended spare parts kit will be minimum 5% of the entire system value of 2+1 @ 0.5 kW system	1 Set	site Borsec

Total price E

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B. FACTORY TRAINING AND FACTORY ACCEPTANCE TESTS

FURNITURE	REQUIREMENTS	Q-ty	PRICE (EURO)
FACTORY TRAINING and FACTORY ACCEPTANCE TESTS	6 persons/ 5 working days Air fare tickets, Accommodation and Living Expenses taken in charge of Supplier: <input type="checkbox"/> Hotel Accommodation <input type="checkbox"/> Lunch on working day <input type="checkbox"/> Living expenses: 100 eur / day / person <input type="checkbox"/> Local transport Insurances	1 Set	

Total price F

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Quotation Grand TOTAL

Item	Description	Price
Total price A	FULL SOLID STATE FM-VHF TRANSMITTER 2+1 @ 1 kW	
Total price B	FULL SOLID STATE FM-VHF TRANSMITTER 2+1 @ 0,5 kW	
Total price C	FULL SOLID STATE FM-VHF TRANSMITTER 1+1 @ 1 kW	
Total price D	SPARE PART KIT for 2+1 @ 1kW and 1+1@1 kW systems	
Total price E	SPARE PART KIT for 2+1 @ 0,5 kW system	
Total price F	FACTORY TRAINING AND FACTORY ACCEPTANCE TESTS	
	TOTAL	

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Freq. List

Site	Frequency	System type
ALEXANDRIA	91,8 MHz	2+1
ALEXANDRIA	89,7 MHz	
BORSEC	101,00 MHz	2+1
BORSEC	98,40 MHz	
BRAȘOV-TÂMPA	102,5 MHz	2+1
BRAȘOV-TÂMPA	105 MHz	
DĂBULENI	99,10 MHz	1+1
GIURGIU	104,6 MHz	2+1
GIURGIU	102,6 MHz	
HOTARELE	91,1 MHz	1+1
MAHMUDIA	100,5 MHz	2+1
MAHMUDIA	102 MHz	
MOLDOVA NOUĂ	105,10 MHz	1+1
NEGREȘTI	89,40 MHz	2+1
NEGREȘTI	93,3 MHz	
SIGHET-FM	106,20 MHz	1+1
VĂRATEC	91,20 MHz	2+1
VĂRATEC	100,80 MHz	
VASLUI	106,10 MHz	2+1
VASLUI	102,40 MHz	
HUSI	101,7 MHz	1+1

QUOTATION LIST

BAND PASS FILTER (3 CAVITIES) 1 kW

No	Site	FURNITURE	REQUIREMENTS	Q-ty	PRICE CIP-site
1	ALEXANDRIA	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 89.7 MHz	1 Pc	
2	BRAȘOV-TÂMPA	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 105 MHz	1 Pc	
3	DĂBULENI	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 99.1 MHz	1 Pc	
4	GIURGIU	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 102.6 MHz	1 Pc	
5	HOTARELE	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 91.1 MHz	1 Pc	
6	MAHMUDIA	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 102 MHz	1 Pc	
7	MOLDOVA NOUĂ	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 105.1 MHz	1 Pc	
8	NEGREȘTI	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 89.4 MHz	1 Pc	
9	SIGHET-FM	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 106.2 MHz	1 Pc	
10	VĂRATEC	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 100.8 MHz	1 Pc	
11	VASLUI	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 102.4 MHz	1 Pc	
12	HUSI	BAND PASS FILTER (3 CAVITIES)	3 cavities, 1 kW, tuned to 101.7 MHz	1 Pc	

Total

TECHNICAL FEATURES FOR VHF FM SOLID STATE TRANSMITTER WITH ACTIVE BACK-UP SYSTEM

I. Configuration

- Full Solid State, air cooled FM transmitters
- Digitally μ P controlled transmitter
- Front Panel Diagnostic Display with detailed system information
- Active reserved system in 2+1 configuration (2 main transmitters + active back-up transmitter, rack and wiring, including full automatic change-over system in case of main transmitter fault: switching controller, RF switching system, audio lines and RDS switching system, dummy load)
- Active reserved system in 1+1 configuration (1 main transmitter + active back-up transmitter, rack and wiring, including full automatic change-over system in case of main transmitter fault: switching controller, RF switching system, audio lines and RDS distribution 1:2, dummy load)

II. Frequency

- | | |
|-----------------------------------|---|
| 1. Frequency range | : 87.5 ÷ 108 MHz software
digitally programmable |
| 2. Exciter | Digital exciter |
| 2.1 Digital controlled oscillator | : included |
| 2.2 Stereo encoder | : included |
| 2.3 Digital Composite Limiter | : included |
| 2.4 Digital Modulator | : included |
| 3. Frequency stability | : +/-150Hz |
| 4. Nominal frequency deviation | : \pm 75 kHz (CCIR 450 - 1) |
| 5. Modulation Capability | : \pm 150 kHz |
| 6. Class of emission | : F8EH |
| 7. Stereo emissions | : according to CCIR recommendation
450, section 2 (pilot tone procedure) |

III. RF Output

- | | |
|---------------------|------------------------------------|
| 1. Output RF power | : according with quotation request |
| 2. Output impedance | : 50 Ω (Unbalanced) |

3. VSWR : Automatic power reduction beyond 1.5:1
 open Transmitter should be protected for short and circuit conditions
4. Spurious emissions (including harmonics): according ETSI EN 302 018, art. 4.2.10
 a. 9kHz-1GHz : max -16dBm (25microW) for tx 1kW
 : better than -75dBc for tx 500W
 b. 108 MHz-137MHz : max -16dBm (25microW)
5. Out-of-band emissions : according ETSI EN 302 018, art. 4.2.12
 a. +/- (200 to 300kHz) : better than -80dBc
 b. +/- (300kHz to 500kHz) : better than -85dBc
6. Output Connector
 - 7/16 DIN

- IV. Modulation Inputs : - 1xAnalog LEFT, RIGHT;
 - 2xDigital XLR inputs, can be used as:
 -0/1/2 AES3 (sample rate up to 96kHz;
 data rate up to 196 kb/s, 16/24/32 bits)
 and/or
 -0/1/2 AES192 digital MPX;
 - 2xMPX (analog);
 - 2xSCA/RDS (for external encoder)
 - automatic switching between input sources
 with silent detection according to user
 configurable thresholds.

V. Transmission characteristics

Stereo operation

1. Modulation frequency range : 30 Hz to 15 kHz
2. Input impedance : 600 ohms, balanced for analog
 110 ohms for digital
3. AF input level : 0 dBu to +10 dBu for analog
 -10 dBFS to 0 dBFS for digital
4. Pre emphasis : 0 μ s, 50 μ s and 75 μ s selectable
5. Stereo Amplitude Response : \pm 0.2 dB (without pre-emphasis)
 referred to $f_{mod}=400$ Hz, 30 Hz to 15 kHz, : \pm 0.2 dB (with pre-emphasis)
 left channel, right channel
6. Crosstalk between left and right channels

100% modulation, 30 Hz to 15 kHz : > 60 dB

7. Distortion (THD), 30 Hz to 15 kHz,
- with 75 kHz frequency deviation : < 0.05%
- with 100 kHz frequency deviation : < 0.05%
left channel, right channel

8. Intermodulation distortion (L or R) : < 0.2%
60Hz/ 7kHz, 4:1, +4dBu

9. FM S/N ratio, referred to $f_{\text{mod}}=400$ Hz at
75 kHz frequency deviation, peak value
measurement, left channel, right channel
- weighted : ≥ 80 dB

Mono operation

10. Amplitude frequency characteristic : ± 0.2 dB
referred to $f_{\text{mod}}=400$ Hz,
40 Hz to 15 kHz

11. FM S/ N ratio, referred to $f_{\text{mod}}=400$ Hz at
75 kHz frequency deviation
- weighted : ≥ 80 dB

12. Asynchronous AM Noise
referred to 100% AM modulation at 400 Hz,
50 μ s Pre-emphasis and without FM modulation : > 55 dB

13. Synchronous AM Noise
referred to 100% AM modulation at 400 Hz,
50 μ s Pre-emphasis with FM modulation at 75 kHz : > 50 dB;

VI. Supply, cooling, environment

1. Supply voltage : 230Vac $\pm 15\%$, 50 Hz ± 3 Hz;

2. Power factor : > 0.95;

3. Overall efficiency : > 65% for Tx < 1kW
> 70% for Tx = 1kW

4. Cooling : Air-cooling with built – in blowers
and fans speed control, automatic
foldback and shut down of the RF
output power has to be provided in
case of temperature fault or air
pressure fault.

5. **Operating temperature range** : 0°C to + 45°C;
6. **Maximum relative humidity** : 95%, non condensing;
7. **Altitude** : up to 2500 m;

VII. Specific requirements

1. **The FM transmitter should assure an uninterrupted and unattended operation during 24 hours/ day.**
2. **The FM Transmitter should be user friendly and simple to operate.**
3. **The equipment quoted must conform to the latest international standards of safety and EMC. The conformance to such standards must be stated in compliance statement (Oferrer will indicate Standard's Name and Number).**
4. **The transmitter shall be characterized by high reliability, high MTBF (15000 hours). An statement need to be provided by manufacturer.**
5. **The transmitters must be installed in a standard 30RU 19" rack including power protection & distribution unit, blind panels, top & rear door and all required internal connections.**
6. **The transmitter should have adequately protection against fire, rust and corrosion. An statement need to be provided by manufacturer.**
7. **Transmitter should display various parameters on LCD display.**
8. **Adequate protection system shall be provided to safe guard the transmitter from damage under fault conditions. The protection system should be fast acting to safe guard the components.**
9. **Typical requirements regarding the protection matter:**
 - **Over- load protection for transmitter.**
 - **Protection against over temperature.**
 - **Main power supply protection.**
 - **Protection against high VSWR including open and short conditions at output.**
 - **Immediate power fold-back under severe/damaging fault conditions. Details of fold-back to be provided**
10. **The FM transmitter must to be provided with calibrated sample port for power measurements**
11. **The FM transmitter must to be provided with automatic switch-on at short interrupting of the main power supply (3 interrupts up to 1 second (in 5 seconds**

interval)). An statement need to be provided by manufacturer. This need to be confirmed by factory test report supplied with the transmitters.

12. A proposal for training on factory and factory acceptance is required (see Quotation list)

13. The FM transmitter will be provided only with air cooling system.

14. A proposal for commissioning (verifying the installation made by customer) on site and site acceptance tests is required (no of persons/ day).

15. A proposal for recommended spare parts kit (included in the offer price) is required. The total value of the recommended spare parts kit will be minimum 5% of the equipment value, see quotation list. The offerer will provide a complete list with the spare parts and price for each item.

16. The FM transmitter must to be provided with full local and remote monitoring and control system with HTML5 web user interface for remote operation.

Minimum requirements:

a) Remote

1. Remote control
 - full transmitter parameters control
2. Minim Remote indication
 - on / off status
 - RF forward and reflected power
 - Audio input status
 - Deviation meter
 - alarms: no carrier, no audio, active fold-back, -3dB carrier
 - fault: RF, power amplifier stage, VSWR, temperature, interlock, main power supply.

b) Local:

Display of following parameters:

1. Transmitter operating parameters (frequency, output and reflected power, RF currents, main power supply voltage and currents, audio input status, alarm list and history);
2. Fault diagnostic: RF chain and exciter, power amplifier stage, VSWR, temperature, interlock, main power supply
3. Alarms: no carrier, no audio, active fold-back
4. Exciter operating parameters
5. Deviation meter

c) Monitoring equipment

Remote interface:

- PC remote and monitor facilities: hardware + software firmware;
- All necessary devices and software to integrate the transmitter into the Radiocomunicatii monitoring system (e.g. SNMP protocol, MIB files, etc);

Audio and modulation monitoring:

- FM demodulator
- Modulation monitor and metering
- Audio monitor
- All required cables to connect monitoring equipment

17. In the furniture the supplier will provide as “technical documentation”, for all furniture, the following items:

- Documentation for the mechanical-electrical fitting,
- Technical manuals containing:
 - Specifications,
 - Installation & initial turn on,
 - Operators guide,
 - Controls and indicators,
 - Overall system theory,
 - Maintenance & alignments,
 - Troubleshooting,
 - Overall system & transmitter diagram.
 - Electronic Boards Diagrams
 - Parts list, etc.

18. All equipments must be conform to the articles of Directive 2014/53/UE(Directiva RED)of the European Parliament and of the council of 9 March 1999 and its amendment acts on radio equipment and telecommunications terminal equipment, and to all European Community standards that apply to the respective type of equipment (including standards for toxic substances), otherwise the equipments cannot be imported under the Romanian law.

All equipments must be “CE” and “RoHS” certified. The offerer has to supply the conformity certificates for all equipments.

The manufacturer has to be certified ISO 9001:2015 and ISO 14001:2015

19. All above requirements are mandatory and must be specified in the technical specifications documentation, released by manufacturer, and will be attached as reference.

Must be indicated pages for each required parameter for reference.

20. Must be quoted prices for each item in quotation lists, including spare parts kit. The parts included in the spare parts kit will be quoted individually.

21. Guarantee periode: 24 months for transmitters and auxiliary equipment.

22. Each transmitter will be delivered with factory test report, including at least the measurements and checks required by FM TransmitterTest document (annexed)

TECHNICAL FEATURES FOR VHF FM SOLID STATE TRANSMITTER WITH ACTIVE BACK-UP SYSTEM

IP input capabilities

The provider must offer, within the transmitter system, the possibility to use IP input technology utilizing redundant WAN networks, with instant replacement of packets that may be lost on WAN1 by packets delivered on WAN2. This must take place seamless without switching between streams. Additionally, the technology must support similar functionality on a single WAN as well by utilizing delivery of delayed streams, where packets from second stream replace lost packets from the first stream. Additionally, and at the same time, the IP source must be selectable between primary and secondary source.

Encoding and decoding for IP signals:

- MPEG2/4: AAC-LC
- Linear PCM
- Opus
- MPEG-TS

Must be able to upgrade with following algorithms:

- MPEG 1/2 Layer II
- MPEG4: AAC-LD/ELD , AAC-HE v1/v2
- E-APT-x



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FM BAND PASS FILTER 1 kW

Type: Min. 3 cavities

Frequency range: 87,5 MHz – 108 MHz

Impedance: 50 OHM

Power= 1kW

Frequency= according with freq. specified in quotation list

Selectivity : selectable +/-1,2 MHz to +/-1,6 MHz

VSWR at Fc: <1,08

Insertion loss: <0,5 dB , selectivity +/-1,6 MHz

Cooling: natural heat dissipation

Y

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Technical compliance for FM transmitter with active back-up system

TECHNICAL FEATURES

Features	Details	Mandatory	Customer Offer	Reference pages
I. Configuration				
Full Solid State, air cooled FM transmitters		Yes		
Digitally μ P controlled transmitter		Yes		
Front Panel Diagnostic Display with detailed system information		Yes		
Active reserved system in 2+1 configuration (2 main transmitters + active back-up transmitter, rack and wiring, including full automatic change-over system in case of main transmitter fault: switching controller, RF switching system, audio lines and RDS switching system, dummy load)		Yes		
Active reserved system in 1+1 configuration (1 main transmitter + active back-up transmitter, rack and wiring, including full automatic change-over system in case of main transmitter fault: switching controller, RF switching system, audio lines and RDS distribution 1:2, dummy load)		Yes		
II. Frequency				
1. Frequency range	87.5 +108 MHz software digitally programmable	Yes		
2. Exciter	Digital exciter	Yes		
Digital controlled oscillator	included	Yes		
Stereo Encoder	included	Yes		
Digital Composite Limiter	included	Yes		
Digital Modulator	included	Yes		
3. Frequency stability	± 150 Hz	Yes		
4. Nominal frequency deviation	± 75 kHz (CCIR 450 - 1)	Yes		
5. Modulation capability	± 150 kHz	Yes		
6. Class of emission	F8EH	Yes		
7. Stereo emissions	according to CCIR recommendation 450, section 2. (pilot tone procedure)	Yes		
III. RF Output				
1. Output RF power	according with quotation request	Yes		
2. Output impedance	50 Ω unbalanced;	Yes		
3. VSWR	a. Automatic power reduction beyond 1.5:1	Yes		
	b. Transmitter should be protected for short and open circuit conditions	Yes		
4. Spurious emissions, including harmonics	according ETSI EN 302 018	Yes		
a. 9kHz-1GHz	max -18dBm (25microW) for tx 1kW better than -75dBc for tx 150W-500W max -16dBm (25microW)			
b. 108 MHz-137MHz				
5. Out-of-band emissions	better than -80dBc	Yes		
a. \pm (200 to 300kHz)				
b. \pm (300kHz to 500kHz)	better than -85dBc			
6. Output Connector	7/16 DIN	Yes		
IV. Modulation Inputs				
	1xAnalog LEFT, RIGHT;	Yes		
	- 2xDigital XLR inputs, can be used as: -0/1/2 AES3/EBU (sample rate up to 96kHz; data rate up to 198 kb/s, 16/24/32 bits) and/or -0/1/2 AES192 digital MPX;	Yes		
	2xMPX (analog);	Yes		
	2xRDS (for external encoder)	Yes		
	automatic switching between input sources with silent detection according to user-configurable thresholds	Yes		
V. Transmission characteristics				
Stereo operation				
1. Modulation frequency range	30 Hz to 15 kHz;	Yes		
2. Input impedance	600 ohms, balanced for analog 110 ohms for digital	Yes		
3. AF input level	0 dBu to + 10 dBu, for analog - 10 dBFS to 0 dBFS for digital;	Yes		
4. Pre emphasis	0 μ s, 50 μ s and 75 μ s selectable	Yes		

5. Stereo Amplitude Response referred to fmod=400 Hz, 30 Hz to 15 kHz, left channel, right channel	± 0.2 dB (without pre emphasis), ± 0.2 dB (with pre-emphasis)	Yes		
6. Crosstalk between left and right channels 100% modulation, 30 Hz to 15 kHz	> 60 dB	Yes		
7. Distortion (THD) 30 Hz - 15 kHz, left channel, right channel		Yes		
- with 75 kHz frequency deviation	< 0.05%	Yes		
- with 100 kHz frequency deviation	< 0.05%	Yes		
8. Intermodulation distortion (L or R) 60Hz/ 7kHz, 4:1, +4dBu	< 0.2%	Yes		
9. FM S/N ratio, referred to fmod=400 Hz at 75 kHz frequency deviation, peak value measurement, left channel, right channel		Yes		
- weighted	≥ 80 dB	Yes		
Mono operation				
10. Amplitude-frequency characteristic referred to fmod=400 Hz, 40 Hz to 15 kHz	± 0.2 dB	Yes		
11. FM S/N ratio, referred to fmod=400 Hz at 75 kHz frequency deviation, peak value measurement		Yes		
- weighted	≥ 80 dB	Yes		
12. Asynchronous AM noise referred to 100% AM modulation at 400 Hz, 50 μ s Pre-emphasis and without FM modulation	> 55dB	Yes		
13. Synchronous AM noise referred to 100% AM modulation at 400 Hz, 50 μ s Pre-emphasis with FM modulation at 75 kHz	> 50dB	Yes		
VI. Supply, cooling, environment				
1. Supply voltage	230Vac $\pm 15\%$, 50 Hz ± 3 Hz	Yes		
2. Power factor	> 0.95	Yes		
3. Overall efficiency	> 65% for Tx < 1kW > 70% for Tx = 1kW	Yes		
4. Cooling	Air-cooling with built-in blowers and fan speed control, automatic foldback and shut down of the RF output power has to be provided in case of temperature fault or air pressure fault	Yes		
5. Operating temperature range	0°C to +45°C	Yes		
6. Maximum relative humidity	95% non condensing	Yes		
7. Altitude	up to 2500 m	Yes		
VII. Specific requirements				
1. The FM transmitter should assure an uninterrupted and unattended operation during 24 hours/ day		Yes		
2. The FM Transmitter should be user friendly and simple to operate.		Yes		
3. The equipment quoted must conform to the latest international standards of safety and EMC. The conformance to such standards must be stated in compliance statement (Offeror will indicate Standard's Name and Number).		Yes		
4. The transmitter shall be characterized by high reliability, high MTBF (15000 hours). An statement need to be provided by manufacturer.		Yes		
5. The transmitters must be installed in a standard 30RU 19" rack including power protection & distribution unit, blind panels, top & rear door and all required internal connections.		Yes		
6. The transmitter should have adequately protection against fire, rust and corrosion. An statement need to be provided by manufacturer.		Yes		
7. Transmitter should display various parameters on LCD display.		Yes		
8. Adequate protection system shall be provided to safe guard the transmitter from damage under fault conditions. The protection system should be fast acting to safe guard the components.		Yes		

9. Typical requirements regarding the protection matter: - Over-load protection for transmitter. - Protection against over temperature. - Main power supply protection. - Protection against high VSWR including open and short conditions at output. - Immediate power fold-back under severe/damaging fault conditions. Details of fold-back to be provided.		Yes		
10. The FM transmitter must to be provided with calibrated sample port for power measurements.		Yes		
11. The FM transmitter must to be provided with automatic switch-on at short interrupting of the main power supply (3 interrupts up to 1 second (in 5 seconds interval)). An statement need to be provided by manufacturer. This need to be confirmed by factory test report supplied with the transmitters.		Yes		
12. A proposal for training on factory and factory acceptance is required (see Quotation list)		Yes		
13. The FM transmitter will be provided only with air cooling system.		Yes		
14. A proposal for commissioning (verifying the installation made by customer) on site and site acceptance tests is required (no of persons/ day).		Yes		
15. A proposal for recommended spare parts kit (included in the offer price) is required. The total value of the recommended spare parts kit will be minimum 5% of the equipment value, see quotation list. The offerer will provide a complete list with the spare parts and price for each item.		Yes		
16. The FM transmitter must to be provided with full local and remote monitoring and control system with HTML5 web user interface for remote operation.		Yes		
Minimum requirements:				
a) Remote		Yes		
1. Remote control	full transmitter parameters control	Yes		
2. Minim Remote indication	<ul style="list-style-type: none"> • on / off status • RF forward and reflected power • Audio input status • Deviation meter • alarms: no carrier, no audio, active fold-back, -3dB carrier • fault: RF chain and exciter, power amplifier stage, VSWR, temperature, interlock, main power supply. 	Yes		
b) Local				
Display of following parameters	1. Transmitter operating parameters (frequency, output and reflected power, RF currents, main power supply voltage and currents, audio input status, alarm list and history);	Yes		
	2. Fault diagnostic: RF chain and exciter, power amplifier stage, VSWR, temperature, interlock, main power supply	Yes		
	3. Alarms: no carrier, no audio, active fold-back	Yes		
	4. Exciter operating parameters	Yes		
	5. Deviation meter	Yes		
c) Monitoring equipment	Remote interface :	Yes		
	• PC remote and monitor facilities: hardware + software firmware;	Yes		
	• All necessary devices and software to integrate the transmitter into the radiocommunications monitoring system (e.g. SNMP protocol, MIB files, etc)	Yes		
	Audio and modulation monitoring	Yes		
	• FM demodulator	Yes		
	• Modulation monitor and metering	Yes		
	• Audio monitor	Yes		
	• All required cables to connect monitoring equipment	Yes		

17. In the furniture the supplier will provide as "technical documentation", for all furniture, the following items:	Documentation for the mechanical-electrical fitting	Yes		
	Technical manuals containing:	Yes		
	- Specifications			
	- Installation & initial turn on			
	- Operators guide			
	- Controls and indicators			
	- Overall system theory			
	- Maintenance & alignments			
	- Troubleshooting			
	- Overall system & transmitter diagram			
	- Electronic Boards Diagrams			
	- Parts list, etc			
18. All equipments must be conform to the articles of Directive 2014/53/UE(Directiva RED) of the European Parliament and of the council of 9 March 1999 and its amendment acts on radio equipment and telecommunications terminal equipment, and to all European Community standards that apply to the respective type of equipment (including standards for toxic substances), otherwise the equipments cannot be imported under the Romanian law. All equipments must be "CE" and "RoHS" certified. The offerer has to supply the conformity certificates for all equipments. The manufacturer has to be certified ISO 9001:2015 and ISO 14001:2015		Yes		
19. All above requirements are mandatory and must be specified in the technical specifications documentation, released by manufacturer, and will be attached as reference; Must be indicated pages for each required parameter for reference.		Yes		
20. Must be quoted prices for each item in quotation lists, including spare parts kit. The parts included in the spare parts kit will be quoted individually.				
21. Guarantee periode: 24 months for transmitters and auxiliary equipment.		Yes		
22. Each transmitter will be delivered with factory test report, including at least the measurements and checks required by FM Transmitter Test document (annexed)		Yes		

**Technical compliance for FM transmitter with active back-up system
IP Input Capabilities**

Features	Details	Mandatory	Customer	Reference pages
<p>The provider must offer, within the transmitter system, the possibility to use IP input technology utilizing redundant WAN networks, with instant replacement of packets that may be lost on WAN1 by packets delivered on WAN2. This must take place seamless without switching between streams. Additionally, the technology must support similar functionality on a single WAN as well by utilizing delivery of delayed streams, where packets from second stream replace lost packets from the first stream. Additionally, and at the same time, the IP source must be selectable between primary and secondary source.</p>		Yes		
<p>Encoding and decoding for IP signals:</p> <ul style="list-style-type: none"> - MPEG2/4: AAC-LC - Linear PCM - Opus - MPEG-TS <p>Must be able to upgrade with following algorithms:</p> <ul style="list-style-type: none"> - MPEG 1/2 Layer II - MPEG4: AAC-LD/ELD , AAC-HE v1/v2 - E-APT-x 		Yes		

**Technical compliance for FM Band Pass Filter 1 kW
TECHNICAL FEATURES**

Features	Details	Mandatory	Customer Offer	Reference pages
Cavities	Min. 3	Yes		
Frequency range	87,5 MHz – 108 MHz	Yes		
Impedance	50 ohms	Yes		
Power	1kW	Yes		
Frequency	according with freq. specified in quotation list	Yes		
Selectivity	selectable +/-1,2 MHz to +/-1,6 MHz	Yes		
VSWR at Fc	<1,08	Yes		
Insertion loss	<0.5 dB , selectivity +/-1,6 MHz	Yes		
Cooling	natural heat dissipation	Yes		

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Table for Key Criteria evaluation

No.	Key Criteria	Minimum required	Maximum Points offered for the most performant value (H) from all offers	Calculated Points for offers with lower performance value (L)<(H)
1	Technical performances	according with table below	60	
3	Price Offer		40	Formula: H/L x 40.
	TOTAL		100	
Table for Technical Performances (stereo operation)				
	Features	Minimum required	Maximum Points offered for the most performant value from all offers	Calculated Points formula
	Stereo amplitude response (AES/Analog inputs)	±0.2 dB (referred to selected pre-emphasis curve)	10	min.point (1) for minimum required value (c) max. points (10) for most performant value (b) span = 9 x is vendor value AFC=Amplitude-Frequency Characteristic Formula: $10 - ((AFCx - AFCb) / (AFCc - AFCb)) * span$
	THD (Total Harmonics Distortion on AES/Analog inputs) 30 Hz - 15kHz, with 75 kHz frequency deviation	≤ 0,05 %	10	min.point (1) for minimum required value (c) max. points (10) for best value (b); span = 9 x is vendor value THD=Total Harmonics Distorsion Formula: $10 - ((THDx - THDb) / (THDc - THDb)) * span$
	S/N ratio, referred to fmod=400 kHz, at 75 kHz frequency deviation, weighted	≥ 80 dB	10	min.point (1) for minimum required value (c) max. points (10) for best value (b); span = 9 x is vendor value SNR=Signal/Noise Ratio Formula: $10 - ((SNRx - SNRb) / (SNRc - SNRb)) * span$



<p>Crosstalk between left and right channels 100% modulation, 30 Hz to 15 kHz</p>	<p>> 60 dB</p>	<p>10</p> <p>min. point (1) for minimum required value (c) max. points (10) for best value (b); span = 9 x is vendor value XTLK=Crosstalk Formula: $10 - ((XTLKx - XTLKb) / (XTLKc - XTLKb)) * span$</p>
<p>Intermodulation distortion (L or R) 60Hz/ 7kHz, 4:1, +4dBu</p>	<p>< 0.2%</p>	<p>10</p> <p>min. point (1) for minimum required value (c) max. points (10) for best value (b); span = 9 x is vendor value ITHD=Intermodulation distortion Formula: $10 - ((ITHDx - ITHDb) / (ITHDc - ITHDb)) * span$</p>
<p>Overall efficiency</p>	<p>> 65% for Tx < 1kW > 70% for Tx = 1kW</p>	<p>10</p> <p>min. point (1) for minimum required value (c) max. points (10) for best value (b); span = 9 x is vendor value OE=Overall Efficiency Formula: $10 - ((OEx - OEb) / (OEc - OEb)) * span$</p>
<p>Total for Technical performances</p>		<p>60</p>

**FM TRANSMITTER TEST
AND
FM SYSTEM ACCEPTANCE**

**to be performed on Dummy Load
each transmitter of 2+1/ 1+1 systems will be
individually tested**

TX s.n.....
Date.....

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1.PERFORMANCE

A) OPERATING FREQUENCY :Pass/ Fail

Carrier stability: _____ +/-150 Hz

Pilot tone stability: _____ kHz (19 kHz \pm 1 Hz)

B) FREQUENCY RESPONSE Pass/ Fail

**LIMIT: WITHOUT PRE -EMPHASIS: WITHIN \pm 0.2 dB
0 dB REF LEVEL = 400 Hz @ 75 kHz DEVIATION**

Freq.	Tx @ 75 kHz		
	WITHOUT PRE-EMPHASIS		WITHOUT PRE-EMPHASIS
	LEFT CHANNEL	RIGHT CHANNEL	MONO
30 Hz			
60 Hz			
125 Hz			
1 kHz			
2 kHz			
6 kHz			
10 kHz			
12 kHz			
15 kHz			

**LIMIT: WITH PRE-EMPHASIS: WITHIN ± 0.2 dB
0 dB REF LEVEL = 400 Hz @ 75 kHz DEVIATION**

Freq.	Tx @ 75 kHz		
	WITH PRE- EMPHASIS		WITH PRE- EMPHASIS
	LEFT CHANNEL	RIGHT CHANNEL	MONO
30 Hz			
60 Hz			
125 Hz			
1 kHz			
2 kHz			
6 kHz			
10 kHz			
12 kHz			
15 kHz			

C) STEREO CROSS TALK Pass/ Fail

LIMIT: 30 Hz TO 15 kHz: BETTER THAN 60 dB

FREQUENCY	Tx @ 75 kHz	
	LEFT TO RIGHT	RIGHT TO LEFT
30 Hz		
60 Hz		
125 Hz		
400 Hz		
1 kHz		
2 kHz		
6 kHz		
10 kHz		
12 kHz		
15 kHz		

D) DISTORSION (THD) Pass/ Fail

LIMIT: <0.05% @ 75 kHz DEVIATION

FREQUENCY	Tx @ 75 kHz		
	STEREO		MONO
	LEFT	RIGHT	
30 Hz			
60 Hz			
125 Hz			
400 Hz			
1 kHz			
2 kHz			
6 kHz			
10 kHz			
12 kHz			
15 kHz			

LIMIT: 0.05% @ 100 kHz DEVIATION

FREQUENCY	Tx @ 100 kHz		
	STEREO		MONO
	LEFT	RIGHT	
30 Hz			
60 Hz			
125 Hz			
400 Hz			
1 kHz			
2 kHz			
6 kHz			
10 kHz			
12 kHz			
15 kHz			



E) INTERMODULATION DISTORSION Pass/ Fail

LIMIT: better than 0.2% USING 60Hz/7 kHz TONES,
4:1, +4dBu

STEREO		MONO
LEFT	RIGHT	
%	%	%

F) SIGNAL TO NOISE RATIO Pass/ Fail

LIMIT : BETTER THAN 80 dB (weighted)
0 dB REF LEVEL = 400 Hz @ 75 kHz DEVIATION RMS DETECTOR

	STEREO		MONO
	LEFT	RIGHT	
WEIGHTED			

G) AM NOISE Pass/ Fail

LIMIT: ASYNCHRONOUS: BETTER THAN 55 dB/ Pilot OFF
 SYNCHRONOUS: BETTER THAN 50 dB/ Pilot ON
 0 dB REF LEVEL = 400 Hz @ 75 kHz DEVIATION

ASYNCHRONOUS	dB
SYNCHRONOUS	dB

H) Spurious emissions (including harmonics): Pass/ Fail

a. 9kHz-1GHz

LIMIT: max -16dBm (25microW) for tx 1kW better than -75dBc for tx 150W-500W

b. 108 MHz-137MHz

LIMIT: max -16dBm (25microW)

HARMONIC	LEVEL
2 nd	
3 rd	
4 th	
5 th	
6 th	
7 th	
8 th	
9 th	
10 th	

SPURIOUS (frequency)	LEVEL

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I) Overall Efficiency Pass/ Fail

Limit: > 65% for Tx < 1kW
> 70% for Tx = 1kW

Overall Efficiency.....

2.METERING

A) FWD AND REFLECTED POWER METERING

FWD PWR		kW
REFL PWR	VSWR	W

TOTAL OPERATING P.A. CURRENTAMPS
P.A. VOLTAGEVOLTS

B) DIAGNOSTIC METERING

-to be detailed by supplier according with transmitter architecture for:

- 1) CURRENTS**
- 2) VOLTAGES**
- 3) TEMPERATURES**

3. OPERATING, ELECTRICAL AND MECHANICAL CHECKS Pass/ Fail



1. Check for full compliance with technical specification requested.
2. Check the automatic switching operation:
 - tx spare automatically activated and replace any of main tx in case of failure
 - program and RDS line switching (for 2+1 system)
3. Check automatic switch-on at short interrupting of the main power supply (3 interrupts up to 1 second (in 5 seconds interval)).
4. Check of the protections.
5. Check of the monitoring equipment.
6. Check for operating RDS System
7. General mechanical checks.
8. Technical documentation provided (Specifications, Installation & initial turn on, Operators guide, Controls and indicators, Overall system theory, Maintenance & alignments, Troubleshooting, Boards Diagrams, Parts list, others)
9. Factory Test Report

Customer signature

Supplier signature

BAND PASS FILTER TEST

Site Test 1kW

THE TESTS INCLUDE:

Tuned Frequency.....

Limits: according with transmitter operating frequency

Selectivity.....

Limits: for +/-0,8 MHz to +/-1,6 MHz: 20 dB

VSWR at Fc.....

Limits: <1,08

Insertion loss.....

Limits: <0,5 dB at Fc +/-1,6MHz

Check of the mechanical execution;

ON SITE REPORT WILL BE PROVIDED